EU Workshop BCS

A Monthly Indicator of the Business Climate in the French Service Industry

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Abstract

Traditionally, economic analysts have relied more on qualitative and quantitative data coming from the industrial sector than the service sector. This may be due to the relative abundance of statistical data dedicated to the first sector. This is however detrimental since the service sector accounts for a large part of total value added. In order to improve upon the thoroughness and the quality of the data at hand, Insee has published the results of its services business survey on a monthly basis together with a synthetic indicator since September 2004. This indicator was built in order to get an easier interpretation of the survey's results and to provide a better economic outlook.

We chose the dynamic factor analysis to extract a synthetic indicator from the main balances of opinion of the services business survey. Indeed, this framework is large enough to deal with the multifrequency data and changes in frequencies of the survey. The parameters are estimated through a Kalman filter. The synthetic indicator is then the expected value of the common factor conditionally on past information.

As in the manufacturing sector, the services indicator can be interpreted as a measure of the business climate from the leaders' point of view. It represents an early signal of the activity in the service sector and complements its industrial counterpart. Moreover, the services indicator can be broken down into the three sub sectors of the services domain: business activities, personal service activities and real estate activities. All in all, these indicators provide a better insight of the underlying economic trend of the service sector.

Last, the economic analyst can use this indicator to update his forecast on a monthly basis. Moreover, combined with the synthetic indicator in the manufacturing sector, the services indicator gives additional information to forecast the GDP.

Key Words:  business surveys, short-term analysis, dynamic factor analysis, unobserved components model, Kalman filter, multifrequency data.

JEL Classification: BTS

* This article was translated with the help of Frédéric Tallet.
1. The Insee business survey plays a key role to measure the activity in the service sector

1.1. The service sector is crucial to the analysis and understanding of the global economic activity

Traditionally, analysts used to favour the results from the business survey in industry, "Activité dans l'industrie". Two main reasons for that:
- first, analysts are above all concerned about the contribution to the global growth of the economy; the industrial activity only represents 23% of the value added (VA) - which is less than the service sector's share in the VA - however, it contributes up to 30% to the variance of the value added (see figure 1 and table 1);
- furthermore, historically, more data are available in the industrial sector and with a longer time span.

However, in France, as in the other developed economies, the service sector\(^1\) tends to play an increasing role:
- this sector represents 45% of the whole value added (see figure 1 and table 1);
- it explains about 30% of the value added variance;
- from 1980 to 2004, the percentage of service activities in the employment of the competitive sector increased by 15 points, from 20% to 35% (see table 2), in line with the outsourcing of some jobs in the industry and the growth of temporary work.

Thus, having an accurate insight of the service sector is crucial to better understand the overall economic outlook. In this respect, the services business survey conducted by Insee plays a key role, as it yields the first available data.

<table>
<thead>
<tr>
<th>Table 1 - Breakdown of the value added (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakdown of the value added</strong>*</td>
</tr>
<tr>
<td><em><strong>from 1978 to 1982</strong></em></td>
</tr>
<tr>
<td><strong>Industry</strong></td>
</tr>
<tr>
<td><strong>Service industries</strong></td>
</tr>
<tr>
<td>• Business activities</td>
</tr>
<tr>
<td>• Personal service activities</td>
</tr>
<tr>
<td>• Real estate activities</td>
</tr>
<tr>
<td>Other market activities</td>
</tr>
<tr>
<td>Market activities</td>
</tr>
<tr>
<td><strong>Source : Insee</strong></td>
</tr>
</tbody>
</table>

\(^1\) Throughout this article, the service industry refers to the sectors covered by the French service sector survey: business activities; personal service activities; real estate activities. It does not include trade, financial intermediation, nor non-market activities (education, health and social work, public administration).
Table 2 - Breakdown of the employment (in %)

<table>
<thead>
<tr>
<th>Industry</th>
<th>... from 1978 to 1982</th>
<th>... from 2000 to 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>41</td>
<td>27</td>
</tr>
<tr>
<td>Service industries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Business activities</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>• Personal service activities</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>• Real estate activities</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Other market activities</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Market activities</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Insee

Figure 1 - Breakdown of the value added and its variance (in %)

Out to read the graph:
23 (industry) + 45 (service industries) + 32 (other) = 100 (value added of the market sectors in 2004)
30 (industry) + 30 (service industries) + 40 (other) = 100 (variance of vaqgr from 1978 to 2004)

where vaqgr is the quarterly growth rate of the market value added; vaqgr is broken down into three parts:

$\text{vaqgr} = \left( \frac{\text{va}_{\text{industry}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{industry}} + \left( \frac{\text{va}_{\text{service ind.}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{service ind.}} + \left( \frac{\text{va}_{\text{other}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{other}}$

thus:

$\text{var}(\text{vaqgr}) = \text{cov}(\text{vaqgr}, \left( \frac{\text{va}_{\text{industry}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{industry}}) + \text{cov}(\text{vaqgr}, \left( \frac{\text{va}_{\text{service ind.}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{service ind.}}) + \text{cov}(\text{vaqgr}, \left( \frac{\text{va}_{\text{other}}}{\text{va}} \right)_{-1} \text{vaqgr}_{\text{other}})$
1.2. The Insee business survey in the service sector

Insee has carried out a business survey in the service sector since January 1988. This survey covers: real estate activities, business activities and personal service activities. It leaves aside financial intermediation and transport.

Initially, the survey was quarterly. Since June 2000, most questions are asked every month in a light version of the questionnaire. The survey results have been published on a monthly basis since September 2004.

Every month, the companies are questioned about their activity in the past three months and their expectations for the next three months. The managers also tell what they think about the global economic outlook of their sectors. Other questions are asked regarding the evolution of the total number of employees and the selling prices. Once a quarter, additional questions are asked to the company leaders, in particular concerning the recent and expected evolution of their operating results and the expected demand for their products.

It should be kept in mind that the questions are qualitative, generally with three possible answers: improvement, no change or deterioration. The breakdown between these three possible answers is displayed in the form of a balance of opinion, that is the difference between the percentage of firms posting an improvement and the percentage posting a deterioration. The month-by-month observation of these balances makes it possible to monitor the evolution of company managers’ opinions on these questions.

As a general thing, business surveys offer some decisive advantages over hard data:
- first of all, they provide a signal that is obtained directly from the economic leaders regarding the short-term evolution of their activity;
- moreover, they are published very soon, by the end of the month of the data collection, in other words sooner than the main macroeconomic aggregates;
- lastly, the results are subject to only very minor corrections. Insee updates the raw results of a given survey when the next survey is published, by taking late responses into account. Seasonally-adjusted series are subject to slight changes as seasonal coefficients are estimated once a year.

However, the interpretation of the survey results is not straightforward for at least two reasons:
- the profile of a given balance of opinion can be quite volatile on a monthly basis;
- the profiles of all the balances of opinion can display opposite evolutions.

In order to make interpretation easier, is it possible to sum up the common information between the main balances of opinion derived from a business survey?
2. Extraction of a monthly synthetic indicator for the service sector in a dynamic factor analysis framework

2.1. A monthly synthetic indicator gives a better understanding of the business climate in the service sector

This issue has been explored for the industrial survey in the mid 1990’s. In order to simplify the interpretation of the business survey in the industrial sector, Insee has in recent years adopted a methodology, namely factor analysis, involving breaking down each balance of opinion into two orthogonal components. One of these is common to all the balances of opinion; the other is specific to the question being considered. The common tendency underlying the main questions of the survey, also known as the common factor, turns out to be a “summary” of the information contained in the survey and has been named the indicator of the business climate (BCI for Business Climate Indicator). This methodology is used by Insee to compile and publish every month a set of national indicators as well as an indicator for the euro zone relative to the industrial sector. These indicators give simple and understandable signals of the economic outlook.

The six main balances of opinion of the service sector survey are taken into account to build a monthly synthetic indicator. However, the construction of a synthetic indicator for the service sector raises specific technical difficulties. Indeed, we have to deal with multifrequency data and changes in frequencies: some series are observed every three months and before June 2000, only quarterly series are observed. The general framework of factor analysis is flexible enough to address these aspects and extract a synthetic indicator from the services survey. As its industrial counterpart, this indicator is a measure of the business climate depicted by the company managers and gives a useful signal of the economic activity.

2.2. Methodology for the construction of a synthetic indicator in the service sector in France

The balances of opinion used in the analysis

We would like to extract a common signal from the six main balances of opinion of the services survey: observed turnover, expected turnover, global prospects, past operating result, expected operating result, expected demand. The first three series are monthly since June 2000, while the three others have remained quarterly (see table 3). All six series seem to share a common pattern (see figure 2).

Table 3 - The series used in the extraction of a common factor

<table>
<thead>
<tr>
<th>Series</th>
<th>Description</th>
<th>Frequency</th>
<th>Available since</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP</td>
<td>Global prospects</td>
<td>Monthly</td>
<td>June 2000</td>
<td>Unavailable before June 2000</td>
</tr>
<tr>
<td>OOR</td>
<td>Observed operating result</td>
<td>Quarterly</td>
<td>1988 Q1</td>
<td></td>
</tr>
<tr>
<td>EOP</td>
<td>Expected operating result</td>
<td>Quarterly</td>
<td>1988 Q1</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>Expected demand</td>
<td>Quarterly</td>
<td>1988 Q1</td>
<td></td>
</tr>
</tbody>
</table>
The unobserved components model

Each balance of opinion is seen as the sum of two unobserved terms:

- a term proportional to the common factor \((\lambda_i F_t)\);
- a component specific to the considered balance of opinion and called a residual \((u_{it})\).

Notice that we are facing two types of difficulties: multiple frequencies (quarterly and monthly series) and breaks in frequencies (for example, the series on expected turnover became monthly in June 2000). So, the static factor analysis is not appropriate to handle this case. Following Doz and Lenglart, we consider this problem in a dynamic factor analysis framework and choose an ARMA(2,1) dynamic for the common factor and an AR(1) for the residuals.

Thus, we get the following monthly parametric model:

\[
\begin{align*}
    y_{it} &= \lambda_i F_t + u_{it} \\
    F_t &= \varphi_1 F_{t-1} + \varphi_2 F_{t-2} + \varepsilon_t - \theta \varepsilon_{t-1} \\
    u_{it} &= \rho_1 u_{i(t-1)} + \varepsilon_{it}
\end{align*}
\]

The common factor \(F_t\) being defined up to a multiplicative constant, we set: \(V(\varepsilon_t) = 1\).

\((\varepsilon_t)\) and \((\varepsilon_{it})\) are the innovations of respectively \((F_t)\) and \((u_{it})\); \((\varepsilon_t)\) and \((\varepsilon_{it})\) are independent gaussian white noises, with respective variances 1 and \(\sigma_i^2\).

\(y_{it}\) \((i = 1 \ldots 6\) represent the six balances of opinion. They are standardized.

The real parameters of this model are: \(\lambda_i, \varphi_1, \varphi_2, \theta, \sigma_i, \rho_i\).
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Recall that:
- this is a monthly model;
- all variables are not observed every month - three series out of six are observed every three months;
- before June 2000 (when the survey became monthly), only quarterly balances of opinion are observed;
- the balance of opinion on global prospects is available only since June 2000.

**Latent state-space representation of the model**

The unobserved components model admits the following linear state-space representation:

\[
\begin{align*}
    y_t &= Z_t \alpha_t \\
    \alpha_t &= A \alpha_{t-1} + w_t \\
    \alpha_0 &\sim N(0, \Sigma) \quad \text{(initial condition)}
\end{align*}
\]

where:
- \( y_t \) is the column vector of balances of opinion for every month \( t \); the dimension \( n_t \) of this vector changes over time since the quarterly series are observed only every three months. Thus, before June 2000, the dimension of \( y_t \) is 0 or 5 and from June 2000, it is 3 or 6;
- \( Z_t \) is the measurement matrix; the number of lines of \( Z_t \) is equal to the number of observations at time \( t \); it is thus time-dependent; for example,

\[
Z_t = \begin{pmatrix}
\lambda_1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
\lambda_2 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
\lambda_3 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
\lambda_4 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
\lambda_5 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
\lambda_6 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
\]

when the six balances are observed,

\[
Z_t = \begin{pmatrix}
\lambda_1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
\lambda_2 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
\lambda_3 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
\lambda_4 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
\lambda_5 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
\lambda_6 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{pmatrix}
\]

when only the three monthly balances are observed;
- \( \alpha_t \) is the state vector, \( \alpha_t = (F_t, \ldots, F_{t-1}, \varepsilon_t, u_t') \) with \( u_t = (u_{1t}, \ldots, u_{6t})' \);
- \( A_{(9,9)} = \begin{pmatrix} \varphi_1 & \varphi_2 - \theta & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \\ \vdots & \ddots & \ddots \\ 0 & \cdots & \cdots & \cdots & \rho_5 \\ 0 & \cdots & \cdots & \cdots & \cdots & \rho_6 \end{pmatrix} \).
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\[
\begin{align*}
- \quad w_i &= R \eta_i \\
\text{(9,1)} & \quad \eta_i = \left( \begin{array}{c}
\varepsilon_i \\
\varepsilon_{it} \\
\varepsilon_{6t}
\end{array} \right) \\
\text{(9,7)} & \quad R = \left( \begin{array}{c}
1 \\
0 \\
1 \\
0 \\
\text{Id}(6)
\end{array} \right)
\end{align*}
\]

\[
\begin{align*}
- \quad E(\eta_i) &= 0 \\
V(\eta_i) &= B = \left( \begin{array}{c}
\sigma_1^2 \\
\quad \\
\quad \\
\sigma_6^2
\end{array} \right) \\
E(w_i) &= 0 \\
V(w_i) &= R B R'
\end{align*}
\]

**Observed state-space representation of the model**

The monthly latent state-space representation does not allow us to use Kalman filtering straightforwardly, since \( Z \) is null two months out of three from January 1988 to June 2000.

However, we can change the time frequency and get an irregular time series. We obtain an observed model \( y_i \) with: \( t' = \text{January 1988, April 1988, July 1988, October 1988 ... January 2000, April 2000, June 2000, July 2000 ... January 2005, February 2005} \) (last observation taken into account in this article).

The new dates \( t' \) are the dates when we observe at least one variable. Call \( t_0 \) (\( t_0 = \text{June 2000} \)) the date from which we have monthly observations. The observed model has also a state-space representation:

\[
\begin{align*}
y_i &= Z_i \alpha_i \\
\alpha_i &= A_i \alpha_{i-1} + w_i,
\end{align*}
\]

where:

- \( y_i \) is the column vector of balances of opinion for every date; its dimension is never equal to zero;
- \( \alpha_i \) and \( Z_i \) are unchanged;
- for \( t' \leq t_0 \), \( A_i = A^3 \), \( V(w_i) = R B R' + A R B R' A' + A^2 R B R' A^2 \) (see \(^2\));
  for \( t' > t_0 \), \( A_i = A, \quad w_i = w_i (\) ;

Note that \( A_i \) and \( V(w_i) \) are now time-dependent. With this state-space representation, we can apply the Kalman filter to compute the likelihood. For the initialization of the filter, we simply set \( \alpha_i \sim N(0, \text{Id}(9)) \) rather than the stationary solution. This choice is motivated by its computational advantage and the fact that the resulting estimator is asymptotically equivalent to the ML estimator.

\(^2\) For \( t' \leq t_0 \), \( A_i \) and \( V(w_i) \) can be derived from the latent model by expressing \( \alpha_i \) as a function of \( \alpha_{i-3} \): \( \alpha_i = A^3 \alpha_{i-3} + w_i + A w_{i-1} + A^2 w_{i-2} \).
**Estimation of the parameters**

The parameters are estimated by likelihood maximization. The following parameters are estimated for the ARMA(2,1) dynamic of the common factor:

\[
F_t = 1.90 F_{t-1} - 0.91 F_{t-2} + \varepsilon_t - 0.87 \varepsilon_{t-1}
\]

**Table 4 - Parameter estimates**

<table>
<thead>
<tr>
<th></th>
<th>(\lambda_i)</th>
<th>(\rho_i)</th>
<th>(\sigma_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT</td>
<td>0.21</td>
<td>0.02</td>
<td>0.64</td>
</tr>
<tr>
<td>ET</td>
<td>0.25</td>
<td>0.03</td>
<td>0.60</td>
</tr>
<tr>
<td>GP</td>
<td>0.28</td>
<td>0.03</td>
<td>0.87</td>
</tr>
<tr>
<td>OOR</td>
<td>0.21</td>
<td>0.02</td>
<td>0.00</td>
</tr>
<tr>
<td>EOR</td>
<td>0.22</td>
<td>0.02</td>
<td>0.38</td>
</tr>
<tr>
<td>ED</td>
<td>0.23</td>
<td>0.03</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Definition of the synthetic indicator**

Once the parameters of the model are estimated, the services synthetic indicator (SSI) can be computed. This indicator is the expectation of the common factor \(F_t\) conditional on the information up to \(t\):

\[
SSI_t = \hat{F}_t = E(F_t | I_t)
\]

**Discussion of the statistical results**

If we look at the estimated coefficients, they seem to reveal a unit root in the ARMA representation. This observation is directly linked to the persistence of the balances of opinion. This issue has already been pointed out by Doz and Lenglart (cf. Doz and Lenglart (1999)). In the present situation, it is even harder to conclude since fewer data are available; the usual tests (Augmented Dickey-Fuller, Phillips-Perron, Schmidt-Phillips, Elliott-Rothenberg-Stock) accept the null hypothesis of non-stationarity.

3. Is the indicator of the business climate in the service sector robust?

Robustness is a highly desired quality when considering the opportunity of a new indicator. Indeed, we rely on the services indicator, especially as it displays some method-free properties. For practical purposes, robustness also means that the indicator will not be too much revised from one year to another. We assessed the robustness of the services synthetic indicator in two ways:

- first, we evaluated its response to a shock on global prospects, the series to which it is most correlated;
- second, we compared the indicator to three alternative common factors built under varying hypothesis.

3.1. The services indicator is not a duplicate of the balance of opinion on global prospects…

The likeliness between the indicator and the balance of opinion on global prospects (see figure 3) suggests that the latter series is itself a good summary of the results of the services business survey. Thus, it may be a concern that the indicator mirrors the evolution of global prospects. It is fortunately not the case as a shock applied to this series is only partially conveyed to the common factor (see
This first experiment lends some confidence in the robustness of the indicator and its interest as a measure of the business climate.

**Figure 3 - Global prospects and services synthetic indicator since June 2000**

![Graph showing global prospects and services synthetic indicator from 2000 to 2004.](image)

- Global prospects
- Services synthetic indicator

**Figure 4 - Global prospects: original and stressed series**

![Graph showing global prospects with shocks from 2000 to 2004.](image)

- Global prospects
- Global prospects with shock n°1
- Global prospects with shock n°2
3.2. and appears to be similar to alternative synthetic indicators also relative to the service sector

The services synthetic indicator (SSI) appears to be quite close to alternative indicators resulting from three different models (see figure 6). This is a further sign of its robustness.

- The alternative indicator n°1 (SSI_STA) is a quarterly indicator computed through a static analysis. It uses only 5 of the balances of opinion since the question on global prospects was introduced in 2000. This indicator is notably used in Bouton and Erkel-Rousse (2003) in addition to the industry synthetic indicator to forecast the French GDP. It is worthy to note the similarities of the two indicators although the quarterly static factor does not take global prospects into account. The main advantages of the dynamic factor over the static one are:
  • its timeliness as it is updated each month using the new information available;
  • its capacity to mix series of different frequencies.

- The alternative indicator n°2 (SSI_DYN_2) is based on the same unobserved components model (UCM) as SSI. But it uses the 18 subseries (6 series for each of the 3 subsectors: real estate activities, business activities, personal service activities) instead of the 6 balances of opinion relative to the service sector as a whole.

- The alternative indicator n°3 (SSI_DYN_3) is also a dynamic factor derived from the 18 subseries. However it is based on a more elaborate UCM, in which each of the 18 opinion balances is the sum of a common part, a sector-based part and an idiosyncratic part. This model is thus made of an indicator common to all subseries and 3 additional sector-based indicators.

In this model, each balance of opinion $y_{ijt}$ is the sum of three terms:

$$y_{ijt} = \lambda_{ij} F_i + \mu_{ij} F_{ij} + u_{ijt},$$

where $i = 1 \ldots 6$ (6 variables) and $j = 1 \ldots 3$ (3 sub sectors).

Each sector-based indicator follows an AR(1) dynamic:

$$F_{ij} = \phi_{ij} F_{ij-1} + \epsilon_{ij}. $$

where $j = 1 \ldots 3$. 

---

Figure 5 - The services indicator computed with a shock on global prospects
Table 5 - Characteristics of the different models

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number of series</th>
<th>State dimension</th>
<th>Number of parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI (*)</td>
<td>6</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>SSI_STA (**)</td>
<td>5</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>SSI_DYN_2 (*)</td>
<td>18</td>
<td>21</td>
<td>57</td>
</tr>
<tr>
<td>SSI_DYN_3 (*)</td>
<td>18</td>
<td>24</td>
<td>78</td>
</tr>
</tbody>
</table>

(*) Monthly dynamic indicator. (**) Quarterly static indicator.

Figure 6 - A comparison of alternative synthetic indicators
4. The role of the services indicator in short-term analysis

4.1. The services indicator gives an outline of the economic outlook in the service sector

The evolution of the economic outlook in the service sector in the last fifteen years can be read through this indicator, which is very correlated with the evolution of the services production (see figure 7) (the correlation coefficient between the indicator and the year-on-year change of the services production is equal to 0.77).

**Figure 7 - Synthetic indicator of the business climate and production in the service sector**

- From 1990 to 1993, the activity in the services slowed down after the strong growth of the late 80’s. This slowdown, which is even stronger between 1992 and 1993, is well mirrored by the indicator.

- From 1996 to 2000, the services grow at a very dynamic rate, especially business activities and personal service activities. An explanation could lie in the boom of new technologies. This dynamic pattern took a break at the end of 1998. The financial crisis in several developing countries in particular in South East Asia brought about a temporary pause of the overall economy.

- From 2001 to 2003, the activity slowed down strongly. In 2002, the synthetic indicator showed a rebound, unlike the production: apparently, the early signals of a recovery brought the entrepreneurs to be too optimistic. Conversely, in Spring 2003, the indicator decreased a lot more than production: several financial events - among which the Enron affair and its repercussion on Arthur Andersen - and above all the Iraq War would have intensified the managers’ pessimism.

- From mid-2003, the indicator confirms the resurgence of activity in the service sector. In 2004, the activity appears to have been rather bumpy. It tends to decelerate in the beginning of 2005, after the survey results peaked in November 2004.
4.2. The reading of the indicators in the three sub sectors leads to a more accurate analysis

A similar synthetic indicator can be computed for the three sub sectors covered by the services survey: real estate activities, business activities and personal service activities (see figure 8). The comparison between the global indicator and the sector-based indicators gives a better understanding of the economic outlook.

- **Business services** account for half of the value added of the service sector. As a consequence, the synthetic indicator of this sub sector is very close to the global indicator. From 1994 to 1995, the business climate in this sub sector improved strongly thanks to the rebound in industrial investment. In 1997, the strong increase of the indicator can be partly explained by the expansion of temporary work due to the industrial recovery.

- After the recession of 1993, the straightening of activity in **personal services** seems less steady than in other sub sectors. In particular, in 1994-1995, the appreciation of the French Franc discouraged foreign tourists and put hotel and restaurant activities under stress. The wave of terrorist attacks in 1995 penalized tourism again. In 2001, the fall of the indicator in personal services is due to the conjunction of several events, among which the September 11th 2001 terrorist attack on America and the slow down of American economy. This sluggishness got even worse at the beginning of 2003 when the war against Iraq broke out: the indicator suddenly decreased. Since mid-2003, personal services activities have grown at a moderate pace, unlike the other sub sectors. Indeed, the increase of the indicator relative to personal services is more gradual than that of the global indicator.

- After a strong increase in the late 80’s, **real estate activities** slowed down in the early 90’s. From 1996 to 2001, the growth of this sub sector appears rather unstable as showed by the volatility of the sector-based indicator. After a stabilization in 2000 and a decrease in 2001, real estate activities have kept improving thanks to accommodating financial conditions and the “Besson” effect. At the same time, the synthetic indicator has been displaying a sharp increase.
4.3. The synthetic indicator is useful to forecast the quarterly growth rate of the services production...

As many results derived from business tendency surveys, the synthetic indicator in the service sector can help to “quantify” the economic outlook. In particular, we can estimate an econometric relation between this indicator and the quarterly growth rate of the services production. The latter is the endogenous variable of the equation; it is explained by its lagged values and the current and passed values of the synthetic indicator. Different equations can be considered depending on available information. Indeed, short-term analysts want to update their forecasts with each new piece of information. For this purpose, they can apply the following two-step method based upon the monthly services synthetic indicator:

1) transform the monthly series into three quarterly series, one for each month of the quarter;
2) estimate several forecasting models, based on these quarterly series.

This approach was initially proposed by Dubois and Michaux (2004). Three quarterly series are created by splitting the monthly indicator according to the place of the month in the quarter (see table 6). This step requires a monthly indicator on the whole period under study, that is to say from 1988. The services indicator, as the survey itself, is quarterly between January 1988 and June 2000. Therefore we had to interpolate it over this period. To do so, we used the smoothed synthetic indicator, which is monthly since January 1988. Then, we can estimate several forecasting models, which take into account new information available each month. These models however have some drawbacks, due to the lack of monthly economic information on the service sector before 2000 and the consequent ad hoc interpolation of the synthetic indicator.

Thus, we estimated four models forecasting the quarterly growth rate of the services production. The first three models use respectively the business survey results of the first, the second and the third month of the quarter under review. The last model uses the results delivered the first month of the following quarter. All in all, we can update our forecast by taking into account the new information available each month. Results presented in table 7 show an improvement of the estimates between the first and the second month of the quarter and then a stabilization of the model fit. These models were estimated over the period 1990 Q1 - 2003 Q4. They are presented in detail in appendix C, with the following specification tests results: Chow’s predictive failure test, normality test, absence of autocorrelation until order 4 and homoskedasticity.

3 Service sector production in volume (base 2000), seasonally and trading-day adjusted. This aggregate comes from quarterly national accounts; it is the sum of the productions of real estate activities, business activities and personal service activities.
4 The smoothed synthetic indicator is equal to the conditional expectation of the common factor given the whole available information, namely quarterly then monthly business surveys since 1988. From 1988 to 2000, this smoothed indicator is very close to a linear interpolation of the filtered indicator.
5 The first quarters were excluded from the estimation period for two reasons: on the one hand, with an increasing number of answering companies, the services business survey gradually reach its cruising speed during the first year; on the other hand the first observations are used to initialize Kalman’s filter giving the synthetic indicator. The estimation period stops in the fourth quarter of 2003, because, when the last draft of this article was written, quarterly national accounts were available in their semi-final version until this date. Beyond 2003, they were in a version known as provisional. The semi-final quarterly national accounts for 2004 are published in May 2006, after the end of this article’s drafting.
6 These models and tests were computed with the Grocer econometric toolbox of the Scilab software. Scilab and Grocer are open source and can be freely downloaded from www.scilab.org and dubois.ensae.net. Cf. Dubois (2004).
How to use new information to update the forecast of the services production growth rate in Q1

Table 6 - How to split the monthly indicator into three quarterly indicators according to the month’s place in the quarter

<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly indicator</th>
<th>« month 1 »</th>
<th>« month 2 »</th>
<th>« month 3 »</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>March</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>July</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Table 7 - Model fit given the last available business survey

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1) (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. R²</td>
<td>0.56</td>
<td>0.62</td>
<td>0.61</td>
<td>0.61</td>
</tr>
<tr>
<td>Residual Standard Deviation</td>
<td>0.44</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
</tr>
</tbody>
</table>

(*) Month 1 (Q+1) : first month of the following quarter.
How to read the table: the model “Month 3 (Q)” uses the business survey of the current quarter’s third month to forecast the quarterly growth rate of the services production. For example, the services production of the first quarter is estimated with March business survey.

7 The endogenous variable, the quarterly growth rate of the services production, has a 0.66 standard deviation.
4.4. ... as well as the gross domestic product, beside the industry synthetic indicator
The services synthetic indicator also brings information on global activity. Thus, it can be used jointly with the synthetic indicator of business climate in industry to predict GDP\(^8\) quarterly growth rate. As for the services production, monthly released data can be used to forecast GDP and update the forecast each month. Before 2000, the services synthetic indicator quarterly series was interpolated using the smoothed indicator. This problem does not arise for the indicator in the industry, which is monthly since the beginning. Then, the services and industry monthly indicators were split into three quarterly series according to the month’s position in the quarter (see table 6).

The first model estimates GDP quarterly growth rate using the indicators released in the first month of the current quarter. Its adjusted R\(^2\) amounts to 0.49. With the business surveys of the following quarter’s first month, the adjusted R\(^2\) goes up to 0.58. As for the services, the model fit improves in the second month (see table 8) and remains stable afterwards.

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1) (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. R(^2)</td>
<td>0.49</td>
<td>0.61</td>
<td>0.61</td>
<td>0.58</td>
</tr>
<tr>
<td>Residual Standard Deviation</td>
<td>0.34</td>
<td>0.30</td>
<td>0.29</td>
<td>0.30</td>
</tr>
</tbody>
</table>

(*) Month 1 (Q+1) : first month of the following quarter.
How to read the table: the model "Month 3 (Q)" estimates GDP quarterly growth rate with the surveys released in the third month of the current quarter. For example, the first quarter’s GDP is estimated with March business surveys.

Can the GDP be predicted using only one of the two synthetic indicators? In order to evaluate “the usefulness” of the services indicator for the forecaster, we applied the method proposed by Davidson and McKinnon (1981). Thus, we made forecasts of the GDP quarterly growth rate with the services indicator on the one hand and with the industry indicator on the other hand, and compared these forecasts. If \(y_t\) denotes the GDP quarterly growth rate, and \(\hat{y}_i^t\) (respectively \(\hat{y}_s^t\)) its forecast from a linear model involving the industry (respectively services) indicator, the services business survey yields additional information to the industry business survey if, in the regression
\[
(y_t - \hat{y}_i^t) = \alpha (\hat{y}_s^t - \hat{y}_i^t) + \nu_t,
\]
the coefficient estimate of \(\alpha\) is statistically different from 0. Conversely, if, in the regression
\[
(y_t - \hat{y}_i^t) = \beta (\hat{y}_s^t - \hat{y}_i^t) + \nu_t,
\]
the coefficient estimate of \(\beta\) is statistically non-null, the industry synthetic indicator contains specific information compared to the services synthetic indicator.

The following table presents the results of this test according to the last available business surveys. The GDP quarterly growth rate is successively forecasted using data of the 1\(^{st}\), 2\(^{nd}\) and 3\(^{rd}\) month of the current quarter and data of the 1\(^{st}\) month of the following quarter (month 1 (Q+1)). The estimating period extends from the first quarter of 1990 to the last quarter of 2003.

\(^8\) Gross Domestic Product in volume (base 2000), seasonally and trading-day adjusted.
\(^9\) The endogenous variable, GDP quarterly growth rate, has a 0.66 standard deviation.
Test for specific information in the services and industry synthetic indicators according to available data

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. R²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry</td>
<td>0.37</td>
<td>0.57</td>
<td>0.54</td>
<td>0.49</td>
</tr>
<tr>
<td>services</td>
<td>0.46</td>
<td>0.52</td>
<td>0.49</td>
<td>0.51</td>
</tr>
<tr>
<td>P-value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry</td>
<td>0.254</td>
<td>0.001</td>
<td>0.004</td>
<td>0.025</td>
</tr>
<tr>
<td>services</td>
<td>0.002</td>
<td>0.072</td>
<td>0.063</td>
<td>0.005</td>
</tr>
</tbody>
</table>

**P-value > 5%**

**P-value > 10%**

How to read the table:

- **Adj. R² - industry**: Adjusted determination coefficient ($R^2$) of the linear regression of the GDP quarterly growth rate on the industry synthetic indicator. The regression of month $M$ involves only business survey data released in the month $M$ of each quarter.

- **P-value - industry**: Student $P$-value of $\beta$ coefficient in the regression: 

  \[
  (y_i - \hat{y}_i) = \beta (\hat{y}_i - \hat{y}_i) + w_i.
  \]

  Under the assumption that coefficient $\beta$ is null, the Student statistics follows a normal distribution $N(0,1)$. The $P$-value represents the probability that a random variable following such a distribution is higher, in absolute value, than this statistics. It thus lies between 0 and 1. The $P$-value is directly comparable to the test threshold significance. A near zero $P$-value means that $\beta$ is statistically non-null and that the industry synthetic indicator contains specific information compared to the services synthetic indicator. For example, industry $P$-value (month 2) = 0.001; at 5% significance level, $\beta$ coefficient is considered to be different from 0, the industry business survey brings additional information compared to the services survey.

This analysis shows that the services indicator is useful to forecast the GDP. Indeed, whatever the date of the forecast, it brings additional information compared to the industry indicator. Vice versa, the industry indicator contains some specific information compared to the services indicator except the first month of the quarter, where it does not seem to contribute to the forecast. All in all, these two business climate indicators appear to be complementary for GDP forecasting.

The industry indicator is available on a monthly basis over a long period of time. Thus, we can take its monthly dynamics into account to try and improve the GDP forecast. This sheds additional light to the comparison with the services indicator. Each of the previous regression uses only the results of one survey out of three. Now, we also use the monthly evolutions of the industry indicator: we use its variations between two consecutive months. For example, during the quarter’s first month (model “Month 1 (Q)”), the equation:

\[
gdpqgr_t = 0.47 + 0.20 isi \_ m1_t + 1.06 (isi \_ m1_t - isi \_ m3_{t-1}) + u_t
\]

replaces the previous equation:

\[
gdpqgr_t = 0.47 + 0.18 isi \_ m1_t + 0.34 (isi \_ m1_t - isi \_ m1_{t-1}) + u_t.
\]

---

10 It is still too early to apply the same method to the services indicator because it is interpolated between 1988 and 2000 and really monthly from June 2000.
Notations:

\( gdpqgr \)  GDP quarterly growth rate

\( isi \)  (monthly) synthetic indicator of the business climate in industry

\( isi\_m1 \)  industry synthetic indicator keeping the first month of each quarter (quarterly)

\( isi\_m2 \)  industry synthetic indicator keeping the second month of each quarter (quarterly)

\( isi\_m3 \)  industry synthetic indicator keeping the third month of each quarter (quarterly)

The term \(( isi\_m1, - isi\_m3_{-1})\) represents the monthly evolution of the industry indicator between the third month of the previous quarter and the first month of the current quarter.

**Test for specific information in the services and industry synthetic indicators according to available data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. R²</td>
<td>industry</td>
<td>0.43</td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>services</td>
<td>0.46</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>P-value</td>
<td>industry</td>
<td>0.043</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>services</td>
<td>0.010</td>
<td>0.008</td>
<td>0.047</td>
</tr>
</tbody>
</table>

This study confirms that the services indicator contributes to forecast the GDP. Moreover, the industry indicator appears to be useful as soon as the quarter's first month.

Conversely, the services indicator can be thought to be penalized by the fact it is truly monthly only since June 2000. For this reason, it was also compared to a "multifrequency" industry indicator, computed with quarterly data before June 2000 and monthly data afterwards (recall: the quarterly surveys are carried out in January, April, July and October).

**Test for specific information in the services and industry synthetic indicators according to available data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj. R²</td>
<td>industry</td>
<td>0.36</td>
<td>0.46</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>services</td>
<td>0.46</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>P-value</td>
<td>industry</td>
<td><strong>0.207</strong></td>
<td><strong>0.081</strong></td>
<td><strong>0.095</strong></td>
</tr>
<tr>
<td></td>
<td>services</td>
<td>0.001</td>
<td>0.003</td>
<td>0.012</td>
</tr>
</tbody>
</table>

\( P-value > 5\% \quad P-value > 10\% \)

Note: before June 2000, only the quarterly observations are used to compute the industry indicator; over this period, it is interpolated by the smoothed common factor (which gives a result very close to a linear interpolation), as the services indicator.

This third approach gives a comparison of the relative contribution of each indicator “all things being equal”, i.e. making the assumption that the two surveys were always carried out with the same frequency. It confirms that the industry and services indicators are complementary to each other.
Conclusion

The framework introduced in this paper is an addition to the Insee toolbox dedicated to short-term analysis. By taking advantage of the well-known Kalman filter, it brings new opportunities to the exploiting of business surveys. The services synthetic indicator illustrates how this framework can be applied to very concrete questions. This indicator combines series of different frequencies and sheds a new light on the sector and subsectors under survey. It can help to “quantify” the economic outlook: it is useful to forecast the quarterly growth rate of the services production and of the GDP. Furthermore, the analyst can take advantage of the information released each month to update its forecasts. Last, the services indicator contains specific information compared to the industry indicator. Thus, both indicators appeared to be complementary in the forecast of the GDP.

However, two shortcomings can be mentioned: the ARMA process may not fit correctly persistent data as the balances of opinion described in this paper; the parameters are estimated by maximum likelihood, which forbids to extract a common factor from a large number of series.

Another question at stake is the recent disconnection between the managers’ opinion and the economic indicators. This question could be further studied by exploring the opportunity of synthetic indicators combining both business surveys and quantitative data, e.g. branch production or industrial index. Last, the methodology described in this paper paves the way to the construction of an “all-sector” synthetic indicator, combining monthly, bimonthly and quarterly series coming from several business surveys.
A Monthly Indicator of the Business Climate in the French Service Industry

References


Appendices

Appendix A - Parameter estimates

Variable names

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT</td>
<td>Observed turnover</td>
</tr>
<tr>
<td>ET</td>
<td>Expected turnover</td>
</tr>
<tr>
<td>GP</td>
<td>Global prospects</td>
</tr>
<tr>
<td>OOR</td>
<td>Observed operating result</td>
</tr>
<tr>
<td>EOR</td>
<td>Expected operating result</td>
</tr>
<tr>
<td>ED</td>
<td>Expected demand</td>
</tr>
</tbody>
</table>

A.1. Parameter estimates for service industries

The following parameters are estimated for the ARMA(2,1) dynamics followed by the common factor:

\[ F_t = 1.90 F_{t-1} - 0.91 F_{t-2} + \varepsilon_t - 0.87 \varepsilon_{t-1} \]

<table>
<thead>
<tr>
<th>( \lambda_i )</th>
<th>( \rho_i )</th>
<th>( \sigma_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>estimate</td>
<td>std</td>
</tr>
<tr>
<td>OT</td>
<td>0.21</td>
<td>0.02</td>
</tr>
<tr>
<td>ET</td>
<td>0.25</td>
<td>0.03</td>
</tr>
<tr>
<td>GP</td>
<td>0.28</td>
<td>0.03</td>
</tr>
<tr>
<td>OOR</td>
<td>0.21</td>
<td>0.02</td>
</tr>
<tr>
<td>EOR</td>
<td>0.22</td>
<td>0.02</td>
</tr>
<tr>
<td>ED</td>
<td>0.23</td>
<td>0.03</td>
</tr>
</tbody>
</table>

A.2. Parameter estimates for real estate activities

The following parameters are estimated for the ARMA(2,1) dynamics followed by the common factor:

\[ F_t = 0.19 F_{t-1} + 0.71 F_{t-2} + \varepsilon_t + 0.53 \varepsilon_{t-1} \]

<table>
<thead>
<tr>
<th>( \lambda_i )</th>
<th>( \rho_i )</th>
<th>( \sigma_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>estimate</td>
<td>std</td>
</tr>
<tr>
<td>OT</td>
<td>0.26</td>
<td>0.05</td>
</tr>
<tr>
<td>ET</td>
<td>0.28</td>
<td>0.06</td>
</tr>
<tr>
<td>GP</td>
<td>0.56</td>
<td>0.28</td>
</tr>
<tr>
<td>OOR</td>
<td>0.30</td>
<td>0.05</td>
</tr>
<tr>
<td>EOR</td>
<td>0.31</td>
<td>0.05</td>
</tr>
<tr>
<td>ED</td>
<td>0.23</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Appendix A - Parameter estimates (followed)

A.3. Parameter estimates for business activities

The following parameters are estimated for the ARMA(2,1) dynamics followed by the common factor:

\[ F_t = 1.86 F_{t-1} - 0.88 F_{t-2} + \varepsilon_t - 0.67 \varepsilon_{t-1} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>( \lambda_i )</th>
<th>( \rho_i )</th>
<th>( \sigma_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT</td>
<td>0.14</td>
<td>0.67</td>
<td>0.25</td>
</tr>
<tr>
<td>ET</td>
<td>0.17</td>
<td>0.39</td>
<td>0.26</td>
</tr>
<tr>
<td>GP</td>
<td>0.19</td>
<td>0.80</td>
<td>0.19</td>
</tr>
<tr>
<td>OOR</td>
<td>0.14</td>
<td>-0.08</td>
<td>0.31</td>
</tr>
<tr>
<td>EOR</td>
<td>0.15</td>
<td>-0.01</td>
<td>0.31</td>
</tr>
<tr>
<td>ED</td>
<td>0.15</td>
<td>-0.59</td>
<td>0.23</td>
</tr>
</tbody>
</table>

A.4. Parameter estimates for personal service activities

The following parameters are estimated for the ARMA(2,1) dynamics followed by the common factor:

\[ F_t = 1.18 F_{t-1} - 0.24 F_{t-2} + \varepsilon_t - 0.23 \varepsilon_{t-1} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>( \lambda_i )</th>
<th>( \rho_i )</th>
<th>( \sigma_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT</td>
<td>0.32</td>
<td>0.51</td>
<td>0.46</td>
</tr>
<tr>
<td>ET</td>
<td>0.37</td>
<td>0.21</td>
<td>0.34</td>
</tr>
<tr>
<td>GP</td>
<td>0.46</td>
<td>0.89</td>
<td>0.18</td>
</tr>
<tr>
<td>OOR</td>
<td>0.31</td>
<td>-0.01</td>
<td>0.53</td>
</tr>
<tr>
<td>EOR</td>
<td>0.34</td>
<td>0.76</td>
<td>0.22</td>
</tr>
<tr>
<td>ED</td>
<td>0.34</td>
<td>0.00</td>
<td>0.41</td>
</tr>
</tbody>
</table>
### Appendix B - Variance analysis

**Variance explained by the common factor (in %)**

<table>
<thead>
<tr>
<th></th>
<th>Service industries</th>
<th>Real estate activities</th>
<th>Business activities</th>
<th>Personal service activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT</td>
<td>73</td>
<td>37</td>
<td>73</td>
<td>66</td>
</tr>
<tr>
<td>ET</td>
<td>95</td>
<td>44</td>
<td>93</td>
<td>87</td>
</tr>
<tr>
<td>GP</td>
<td>91</td>
<td>54</td>
<td>91</td>
<td>97</td>
</tr>
<tr>
<td>OOR</td>
<td>81</td>
<td>65</td>
<td>80</td>
<td>69</td>
</tr>
<tr>
<td>EOR</td>
<td>89</td>
<td>69</td>
<td>88</td>
<td>84</td>
</tr>
<tr>
<td>ED</td>
<td>94</td>
<td>39</td>
<td>90</td>
<td>81</td>
</tr>
</tbody>
</table>
Appendix C - Models to forecast the quarterly growth rates of the GDP and the services production


**Notations**

- $spqgr$: services production quarterly growth rate
- $gdpqgr$: GDP quarterly growth rate
- $isi$: (monthly) industry business climate synthetic indicator
- $isi\_m1$: industry synthetic indicator keeping the first month of each quarter (quarterly)
- $isi\_m2$: industry synthetic indicator keeping the second month of each quarter (quarterly)
- $isi\_m3$: industry synthetic indicator keeping the third month of each quarter (quarterly)
- $ssi$: (monthly) services business climate synthetic indicator
- $ssi\_m1$: services synthetic indicator keeping the first month of each quarter (quarterly)
- $ssi\_m2$: services synthetic indicator keeping the second month of each quarter (quarterly)
- $ssi\_m3$: services synthetic indicator keeping the third month of each quarter (quarterly)
- $cst$: constant

**Specification tests**

- **Durbin-Watson**: Durbin-Watson statistics tests for residual first order autocorrelation.
- **Conditioning index**: This index helps to detect possible multicolinearity between explanatory variables. Pathological situations correspond to a maximum conditioning index higher than 30, see Belsley, Kuh and Welsch (1980).
- **Chow(50%)**: Chow predictive failure test on respectively 50% and 90% of the period, see Hendry (1979). The parameter estimates stability is tested by re-estimating the model on a sub-sample (here, 50% and 90% of the full sample).
- **Chow(90%)**: Chow predictive failure test on respectively 50% and 90% of the period, see Hendry (1979). The parameter estimates stability is tested by re-estimating the model on a sub-sample (here, 50% and 90% of the full sample).
- **Normality**: Normality test, see Doornik et Hansen (1994).
- **Autocorrelation (order 4)**: Lagrange multiplier test on residual autocorrelation up to fourth order, see. Godfrey (1978).
- **Heteroskedasticity**: Test for quadratic heteroskedasticity between regressors, see Nicholls and Pagan (1983).

These specification tests are recommended by Krolzig and Hendry (2001).
### Models forecasting the services production according to the last available survey

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cst</td>
<td>0.40 (3.04)</td>
<td>0.38 (3.08)</td>
<td>0.43 (3.53)</td>
<td>0.42 (3.40)</td>
</tr>
<tr>
<td>spqgr(-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spqgr (-2)</td>
<td>0.53 (4.08)</td>
<td>0.57 (4.59)</td>
<td>0.51 (4.21)</td>
<td>0.53 (4.32)</td>
</tr>
<tr>
<td>ssi_m1</td>
<td>0.59 (4.56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssi_m1(-1)</td>
<td>-0.43 (-3.15)</td>
<td>0.77 (5.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssi_m2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssi_m2(-1)</td>
<td>-0.59 (-3.70)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssi_m3</td>
<td></td>
<td></td>
<td>0.70 (5.01)</td>
<td></td>
</tr>
<tr>
<td>ssi_m3(-1)</td>
<td></td>
<td></td>
<td>-0.45 (-2.88)</td>
<td></td>
</tr>
<tr>
<td>ssi_m1(+1)</td>
<td></td>
<td></td>
<td></td>
<td>0.44 (5.45)</td>
</tr>
<tr>
<td>ssi_m1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssi_m1(-1)</td>
<td></td>
<td></td>
<td>-0.20 (-2.10)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted R²</td>
<td>0.56</td>
<td>0.62</td>
<td>0.61</td>
<td>0.61</td>
</tr>
<tr>
<td>Residual standard deviation (2)</td>
<td>0.44</td>
<td>0.41</td>
<td>0.41</td>
<td>0.41</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.75</td>
<td>1.78</td>
<td>1.89</td>
<td>1.91</td>
</tr>
<tr>
<td>Conditioning index</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Chow (50%) (3)</td>
<td>0.49</td>
<td>0.56</td>
<td>0.40</td>
<td>0.38</td>
</tr>
<tr>
<td>Chow (90%) (3)</td>
<td>0.89</td>
<td>0.87</td>
<td>0.51</td>
<td>0.62</td>
</tr>
<tr>
<td>Normality (3)</td>
<td>0.07</td>
<td>0.06</td>
<td>0.35</td>
<td>0.33</td>
</tr>
<tr>
<td>Autocorrelation (order 4) (3)</td>
<td>0.58</td>
<td>0.24</td>
<td>0.53</td>
<td>0.51</td>
</tr>
<tr>
<td>Heteroskedasticity (3)</td>
<td>0.32</td>
<td>0.60</td>
<td>0.78</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Student statistics of parameter estimates are indicated between brackets.
(1) Month 1 (Q+1): First month of the following quarter.
(2) The residual standard deviation can be compared with the standard deviation of the services production quarterly growth rate, which is 0.66 over the estimate period (1990 Q1 - 2003 Q4).
(3) P-value.
### Models forecasting the GDP according to the last available survey

<table>
<thead>
<tr>
<th>Model</th>
<th>Month 1 (Q)</th>
<th>Month 2 (Q)</th>
<th>Month 3 (Q)</th>
<th>Month 1 (Q+1) (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cst</td>
<td>0.75</td>
<td>0.76</td>
<td>0.71</td>
<td>0.73</td>
</tr>
<tr>
<td>gdpqgr (-1)</td>
<td>-0.35</td>
<td>-0.36</td>
<td>-0.36</td>
<td>-0.29</td>
</tr>
<tr>
<td>isi_m1 - isi_m1(-1)</td>
<td>0.43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>isi_m2 - isi_m2(-1)</td>
<td></td>
<td>0.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>isi_m3 - isi_m3(-1)</td>
<td></td>
<td></td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>isi_m3(-2)</td>
<td></td>
<td></td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>ssi_m3</td>
<td>0.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>isi_m1(+1) - isi_m1</td>
<td></td>
<td></td>
<td></td>
<td>0.51</td>
</tr>
<tr>
<td>ssi_m1(+1)</td>
<td></td>
<td></td>
<td></td>
<td>0.45</td>
</tr>
</tbody>
</table>

- **Adjusted R²**
  - Month 1: 0.49
  - Month 2: 0.61
  - Month 3: 0.61
  - Month 1 (Q+1): 0.58

- **Residual standard deviation (2)**
  - Month 1: 0.34
  - Month 2: 0.30
  - Month 3: 0.29
  - Month 1 (Q+1): 0.30

- **Durbin-Watson**
  - Month 1: 1.94
  - Month 2: 1.83
  - Month 3: 1.98
  - Month 1 (Q+1): 1.98

- **Conditioning index**
  - Month 1: 4
  - Month 2: 4
  - Month 3: 6
  - Month 1 (Q+1): 4

- **Chow (50%) (3)**
  - Month 1: 0.51
  - Month 2: 0.55
  - Month 3: 0.45
  - Month 1 (Q+1): 0.59

- **Chow (90%) (3)**
  - Month 1: 0.63
  - Month 2: 0.50
  - Month 3: 0.37
  - Month 1 (Q+1): 0.43

- **Normality (3)**
  - Month 1: 0.15
  - Month 2: 0.84
  - Month 3: 0.33
  - Month 1 (Q+1): 0.95

- **Autocorrelation (order 4) (3)**
  - Month 1: 0.59
  - Month 2: 0.88
  - Month 3: 0.97
  - Month 1 (Q+1): 0.72

- **Heteroskedasticity (3)**
  - Month 1: 0.43
  - Month 2: 0.29
  - Month 3: 0.64
  - Month 1 (Q+1): 0.45

Student statistics of parameter estimates are indicated between brackets.

1. **Month 1 (Q+1): First month of the following quarter.**
2. **The residual standard deviation can be compared to the standard deviation of the GDP quarterly growth rate, which is 0.47 over the estimate period (1990 Q1 - 2003 Q4).**
3. **P-value.**

---

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Insee carries out business surveys in the main market sectors: industry, building, public works, retail trade, wholesale trade, services. The opinion balances derived from these surveys are of varying frequencies: monthly, bimonthly or quarterly. The framework described in this study (or multifrequency Kalman filter) is fit to compute an indicator based on the main results of these surveys (see figure 10).

Figure 10 - A synthetic indicator based on 29 opinion balances coming from 6 different business surveys (industry, building, public works, retail trade, wholesale trade, services)